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March 5, 1999

VIA HAND DELIVERY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
The Portals TW-A325
445 12th Street, S.W.
Washington, DC 20554

Re: ET Docket No. 95-18
Reply Comments of NUCOMM, INC.
Our File 10500/002001

Dear Ms. Salas:

Enclosed please find an original and four copies of Reply Comments for NUCOMM, Inc. to be filed in the above-captioned proceeding.

Please contact the undersigned counsel if you have any questions regarding this matter.

Very truly yours,

Terry G. Mahn

Enclosures

cc: Dr. John B. Payne, NUCOMM, INC.
Service List

96103.W11

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for use by the Mobile-Satellite Service	)	ET Docket No. 95-18

Reply Comments of NUCOMM, Inc.

NUCOMM, Inc., by its attorneys, hereby submits these Reply Comments in the above-captioned Rule Making proceeding. NUCOMM's reason for filing these comments is two-fold; (1) to correct the Commission's official record concerning a textual reference on analog channelization that was falsely attributed to Dr. John Payne, president of NUCOMM; and (2) to offer relevant technical data and analysis on the equipment conversion process required in order to comply with the Commission's new channelization plans for the 2 GHz BAS allocation.

Introduction

NUCOMM, founded in 1990 by Dr. John B. Payne[1], is in the business of designing, manufacturing and marketing digital and analog wireless STL (station to transmitter), ENG (electronic news gathering) and portable video microwave equipment used in the television,

[1] Dr. Payne was the founder of Communication Techniques Inc. (CTI) in 1973, serving as President and Chief Scientist until 1987, when the company was sold to the Dover Corporation.

common carrier and cable industries. Products manufactured by NUCOMM also include digital and analog systems designed specifically for HDTV, including miniature and portable transmitters and receivers used in local and long haul point-to-point applications.[2] In 1997, NUCOMM pioneered the application of narrow band (less than 10 MHz) digital video for ENG by demonstrating its practical application in New York City. NUCOMM also pioneered an all-digital system for the simultaneous transmission of both NTSC and HDTV programming over a single microwave STL link.

I. NUCOMM's Study on Digital Systems for STL and ENG Applications

On February 11, 1998, NUCOMM submitted an *ex parte* letter and technical study to the Commission in this docket, describing the favorable results from a series of tests using digital microwave for STL and ENG applications. The NUCOMM study demonstrated that digital BAS signals could be transmitted in 10 MHz channels with excellent results. Nowhere in the study was there any discussion or mention of transmitting analog BAS signals in 12 MHz channels.

In the Memorandum Opinion and Order and Third Notice of Proposed Rulemaking and Order in this docket, the NUCOMM study was cited, at footnotes 66 and 67, in support of the following statement:

> "Studies and information that have become available since the adoption of the *First R&O/Further Notice* indicate that it is possible to transmit FM analog BAS signals in channels as narrow as 12 megahertz and digital BAS signals in channels as narrow as 10 MHz.[66] An allocation of 85 megahertz for BAS could

[2] In addition, NUCOMM offers a wide rang of digital products designed for HDTV, including a complete range of options and accessories, such as video test signal generators, antennas, duplexous Hot-Standby systems, digital modems, and battery packs.

> provide six channels of 12 megahertz, and one of 13 megahertz, for operations. This would appear to satisfy BAS need for seven distinct channels.[67]"

Except for the reference to digital BAS signals being transmitted in 10 MHz channels, one of the specific findings of the NUCOMM study, the Commission's reference to analog BAS operating in 12 MHz channels must have come from some other source, as nowhere in the NUCOMM study was there any discussions of transmitting analog BAS in other than a 17 MHz bandwidth.

As the NUCOMM study notes, it purpose was to address concerns raised by several ENG engineers and technicians as to the feasibility and reliability of digital transmissions in narrow ENG channels. The study's submission was not intended to influence the Commission's thinking or efforts to reduce the 2 GHz bandwidth for analog BAS. Unfortunately, the textual reference to 12 MHz analog channels in the same sentence as the 10 MHz digital channels, created the impression that the study supported a reduction in the current 17 MHz analog BAS allocation. This reference was both misleading and unfortunate, as it has given the television industry the wrong impression that NUCOMM was encouraging the Commission to reduce the 2 GHz ENG bandwidth. As a result, NUCOMM has been criticized by several of its important customers and its business has suffered from the fallout. Accordingly, NUCOMM requests that the Commission correct its record in this proceeding to make clear that its study did not support a reduction in analog channel bandwidth.

II. Conversion Procedures for 12 MHz Analog and 10 MHz Digital BAS

A. Analog Conversion

Notwithstanding NUCOMM's desire, in these comments, to distance itself from any inference that it advocated or urged a channel reduction for analog BAS, it does have relevant expertise to share on this subject for the benefit of both the industry and the Commission. In the case of much of the 17 MHz BAS equipment on the market, conversion to 12 MHz channels can be accomplished rather easily as follows:[3]

- Equipment deviation must be reduced from the present 8 MHz/volt peak-to-peak to about 6 MHz/volt peak-to-peak;
- The audio subcarrier level must be increased to compensate for the reduced video deviation; and
- The frequency plan of the unit must be changed, usually requiring only the replacement of a PROM.[4]

These adjustments can be made in the field or at the factory, although factory realignment is recommended. For NUCOMM systems these changes will involve only a one-day turnaround, depending on backlog of retrofits and the complexity of the unit. As an option, the BAS equipment manufacturer can install a switch to select between the current and new channel plan to enable instant change over at the customer's option.

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[3] NUCOMM's analog portable ENG and miniature 2 GHz transmitters (PT ¾, MMPT3 and MPT ⅛) are convertible in this fashion.

[4] All NUCOMM synthesizers and power amplifiers are broadband and do not require any re-tuning other than PROM replacement.

In the case of analog portable and central receivers, the procedures to change over differ only slightly, as follows:

- The video output level must be increased to compensate for the reduced video deviation at the transmitter (again, this is an internal adjustment that can be made in the field or at the factory).
- The frequency plan of the receiver must be changed (again requiring the replacement of a PROM).[5]
- For many central receivers there are two switchable IF bandwidths, typically 10 and 17 MHz; both should give good performance with the 12 MHz channel plan, however, to optimize performance, a 10 MHz IF filter may be changed to a 12 MHz filter. (Note: some customers may have purchased the optional two switchable bandwidth IF's, which would require an upgrade.)

Regardless of how the BAS equipment supplier converts its customers to a 12 MHz analog plan, there will be some noticeable degradation in both the video signal-to-noise (S/N) ratio and in the receiver signal a threshold level. The audio S/N will, however, not be effected except for the receiver threshold. NUCOMM understands that tests are being conducted by others involved in this proceeding to provide additional information on the level of degradation involved in a 12 MHz conversion. Should the Commission move forward with its rechannelization plan, because of the widespread impact on the BAS industry, NUCOMM

[5] All NUCOMM synthesizers and LNA's are broadband and will not require any re-tuning. As noted above, at the customers option, a switch can be installed to select between the present and the new channel plan to enable instant channel change over.

recommends that the Commission provide a phase-in period of two to three years. Existing analog equipment can be configured in advance, as described above, allowing broadcasters to change over during this phase-in period based on their own regional planning needs.

B. Digital Conversion

For digital operation within a 12 MHz channelization, BAS customers will be looking at three basic forms of modulation: FSK, QPSK (or QAM) and COFDM. FSK can be transmitted through existing analog equipment whereas 4FSK can transmit video in a 12 MHz channel. The receiver threshold level will be reduced to about - 80 dBm. Since the spectral shape of FSK is triangular (QPSK & COFDM are rectangular), the adjacent channel interference will be degraded.

QPSK (QAM) or COFDM modulation will require ENG analog transmitters to be replaced. Analog modulated transmitters use direct synthesizer modulation and cannot transmit the QAM or COFDM modulation. The output of these modulators (typically 70 MHz) must be up-converted to the transmit frequency and amplified to the desired power level. The power amplifier must be operated in a linear mode. Most analog amplifiers are designed to operate in saturation.[6]

In terms of performance, analog performance is measured at a threshold defined as a video S/N of 37 dB. At this S/N level, the video is noisy and the audio is unusable. In

[6] All NUCOMM mast-mounted power amplifiers in the field today will be able to be factory modified to pass the digital signals. However, many older power amplifiers from other manufacturers that use bi-polar transistors will most likely have to be replaced.

contrast, digital performance is measured at the "cliff point" (i.e, where the video and audio "freeze"). Up to the cliff point both audio and video are perfect.

Performance using 8VSB, QPSK or COFDM will in general be equal to or better than analog performance (i.e., threshold worse than or equal to the cliff point). Tests conducted by NUCOMM and others have shown that 8VSB gives performance about equal to analog and QPSK gives about 3 dB improvement in the cliff point over analog modulation. QPSK was found to perform better than analog in multipath conditions. COFDM modulation also gives improved cliff point performance and is superior to 8VSB, QPSK and analog with respect to multipath.

Although digital modulation gives improved performance, it comes at a price. At present, a video encoder is required to digitize and compress the analog video. Typical encoder costs today are in the range of $30,000 to $60,000, although work being done by various manufacturers will reduce this cost significantly over time. A digital modulator is also required to convert the digital signal to a 70 MHz RF signal. At present a QPSK modulator costs about $7,500, although some encoders come with the modulator built-in at considerably lower cost. COFDM modulators are not available in production for ENG applications, although prototype units are being tested and demonstrated by several manufacturers. COFDM prices are in the $15,000 to $40,000 range, but should come down significantly as chip sets are developed and become available.

Some manufacturers, including NUCOMM, have designed and developed equipment capable of operating in both analog and digital modes specifically to ease the transition from analog to digital BAS. NUCOMM, for example, has developed and is delivering two models

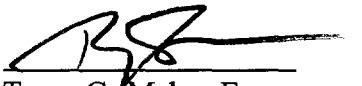
of a portable dual mode ENG transmitter for just such applications. These models are part of NUCOMM's DIALOG product series, which operate in both analog and digital mode. Both models will handel FSK, QPSK, 16QAM and COFDM modulations. The PT6 is the portable transmitter and the MMPT6 "NEWSCASTER" is the ENG truck transmitter. Both come standard with an analog modulator and a front panel switch to instantly convert the units for digital operation.

Most Central Receivers being converted will already handle all but COFDM digital modulation. In digital ENG field tests conducted by NUCOMM in New York City several years ago, a standard NUCOMM 20CR4 receiver was used as well as an older NURAD receiver. The 70 MHz IF outputs were connected to the digital demodulator and performed flawlessly. For COFDM, however, the synthesizer must be replaced with a low phase noise and ultra stable synthesizer. To operate in the proposed 2 GHz channels other modifications, as mentioned above, may also need to be made.

Conclusion

Based on the foregoing, NUCOMM requests that the record in the proceeding be corrected to reflect that it has never provided technical data in support of the Commission's proposal to reduce analog BAS channels from 17 MHz to 12 MHz. Nonetheless, should the Commission proceed with its plan, NUCOMM requests that the expertise it has developed specifically to facilitate conversion to narrow analog and digital BAS Channels be carefully considered in developing the final rules and transition periods in this proceeding.

Respectfully submitted



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March 5, 1999

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